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ATTRIBUTES OF AN IDEAL RAPID VISUAL SCREENING PROCEDURE

In order to evaluate existing RSP's, a set of criteria is required against which present RSP's can be judged. In this chapter, the attributes of such an "ideal rapid visual screening procedure" are presented. These ideal attributes have been determined based on a review of rapid visual screening procedures, as presented in the following sections, as well as the general experience of the project participants in conducting numerous field surveys and analyses of existing buildings. No single, currently available RSP satisfactorily incorporates all of the attributes indicated below.

Applicability to All Building Types: A rapid visual screening procedure for identifying seismically hazardous buildings should provide an initial assessment of the seismic hazard of individual buildings and therefore it should not be limited to one type of building structure. Rather it should be capable of identifying hazardous buildings of all construction types. For example, many rapid visual surveys have been limited to identifying unreinforced masonry (URM) structures, based on the assumption that these are the most hazardous buildings in the community. Although URM hazards have thus been identified, other (sometimes greater) hazards, for example, related to older tilt-up or non-ductile concrete buildings, have gone uncounted. Should the need arise, an RSP could be applied to only one structural category. However, all building groups should receive at least an initial limited-sample test screening in a portion of the community, to verify assumptions of which building type is the most hazardous. If these assumptions are verified, then selected building groups/areas may be targeted, for reasons of economy. The situation of, for example, identifying all unreinforced masonry buildings and having no idea of the seismic hazards in the non-ductile reinforced concrete building group, or the house-over-garage building group, should be avoided.

Quantitative Assessment: Assessment of the hazard should be quantitative as it not only permits pass/fail decisions, but also provides a ranking system that may be used to set priorities within the "failed" category. A quantitative scheme also has the advantage of assuring a more uniform interpretation of the weights of "structural penalties" by survey personnel.

Nonarbitrary Ranking System: Although several of the studies reviewed do include quantitative approaches, these scoring systems are arbitrary and provide relative hazard assessments rather than an estimate of actual hazard based on physical parameters. A quantitative ranking system, which is useful for ranking structures for hazard abatement, should be nonarbitrary to avoid misleading results. The scores should be rationally based, and include uncertainty when possible. Their development should be clear so that new data can be incorporated as they become available and so that the scores can be modified for local building conditions.

Supplemental Information: As much as possible, supplemental information from building department and assessor's files, insurance (Sanborn) maps, previous studies and other sources should be collated and taken into the field in a usable format, for verification as well as to aid field personnel. Ideally, these data should be in a form so that information can be easily attached to each survey form as it is completed (e.g., a peel-off label or a computergenerated form, with part identifying the building and containing pre-field data, and part to be filled out in the field).

Earthquake Definition: An important attribute is that the earthquake loading against which the capacity of the building is being judged be defined explicitly, preferably in physically based units such as acceleration. Otherwise it is unclear what "earthquake" loading the structures are being judged against and, further, the RSP is limited in its application to the region for which it was developed. Structures will have different damage potential in regions with different seismicity; thus a clear definition of the seismic demand should be included. Although a few of the available methods do include some explicit earthquake definitions, in most of these it is in the form of Modified Mercalli Intensity or Uniform Building Code zone. The complex questions of what earthquake loading a building should withstand and what the "acceptable risk" should be often require iterative solutions; therefore, it is possible that a re-screening could occur at a later time. Thus sufficient building-specific data should be recorded to permit adjustments should the input earthquake data be modified.

Data Collection: Organization of the data is an important part of an RSP. Specific details of structural type and configuration, site conditions, and non-structural aspects should be in a checklist format to avoid omissions. The data collection form should provide space for sketches, photos, and comments and should systematically guide personnel through the data recording procedure. Sketches and photos are invaluable for later reference. Both should be an integral part of the field data recording, because they are complementary. (A photo is data intensive, whereas a sketch emphasizes selected features, such as cracks, that may not be easily discernible on a photo of an entire building. In addition, requiring a sketch forces the surveyor to observe the building in a systematic fashion.)

Systematic and Clear Criteria: It is essential that an RSP, and the decisions deriving therefrom, be based on well-documented criteria and that "judgment" decisions be minimized. Although it is anticipated that survey personnel will have some interest in the elements of earthquake behavior of buildings and be capable of making subjective decisions when necessary, they should be provided with extensive written guidelines to avoid differing interpretations of the criteria for identifying hazardous buildings. Documentation should include many sketches as well as "inferences," or rules, to assist personnel in making decisions when information is uncertain.

Age: Age should be explicitly recorded. Often unavailable, age can be estimated, usually within a decade or two, on the basis of architectural style. Age can indicate whether a building is pre- or post- a specific "benchmark" year in the development of seismic codes for that building type. For example, in San Francisco, wood-frame buildings were required to be bolted to their foundations only since 1948. If a wood-frame building was built before 1948, it is likely that it is unbolted. These benchmark years differ by jurisdiction, but usually are locally known or can be determined.

Condition: State of repair is an important factor in seismic performance, and should be required to be noted, as it forces the survey personnel to look for problems such as cracks, rot, and bad mortar. Where relevant, this would include previous earthquake damage. Additionally, renovation should be noted, where possible. Renovation can be positive, because it indicates increased investment (which may have led to improvements in the structure), and/or negative, when it masks the true age of the structure. Additionally, renovation may have resulted in the removal and/or alteration of important structural members and thus may affect seismic performance. A common example is the "addition" of loading doors by saw-cutting of walls in tilt-up buildings, which actually removes seismic resistance.

Occupancy: Occupancy should be noted, as it is a factor in overall risk and may be required for subsequent decision making. How it will be factored into seismic hazard decision making is sometimes a difficult question. In some of the surveys reviewed, buildings were classified into high, medium, and low risk categories depending on the occupancy. This information was then used to rank the hazardous structures.

Configuration: Configuration issues should be noted and their contribution to the hazard quantified. It is clear from past experience that structural irregularities can be significant in the performance of a building during an earthquake. Many of these issues have been identified by Arnold and Reitherman (1981), and include items such as soft story, vertical and/or horizontal discontinuities, and irregularities of plan.

Site Aspects: Site aspects such as potential pounding between buildings, adjacent potentially hazardous buildings, corner buildings, and soil conditions need to be noted and quantified. By quantifying poor site conditions as "penalties," the survey personnel will have a uniform interpretation of the importance of each of the issues in the performance of the building.

Non-structural Architectural Hazards: Earthquake damage to building ornamentation or exteriors can lead to significant damage and/or life-safety hazard. Common examples include the fall of parapets, chimneys, and other overhanging projections.

Personnel Qualifications: Personnel background and training may prove critical to the results of an RSP. An ideal RSP should rely as little as possible on the need for extensive technical education or experience on the part of the personnel involved. Ideally, technician-level individuals (high school plus one to two years equivalent education/experience) should be able to perform the RSP, after one or two days of specialized training.

Hazard Analysis Scheme: Finally, for an ideal RSP the scheme for combining scores to identify the degree of seismic hazard for a building structure should be simple and fast, involving little or no field calculations beyond simple arithmetic.

The following chapters first present a summary of each of the RSP's identified, then evaluate them against the above "ideal" attributes, and finally, present a recommended procedure.